In the present Office Action, Claims 1-19 and 21-43 stand rejected under 35 U.S.C. §103 as allegedly unpatentable over the combined disclosures of U.S. Patent No. 5,620,907 to Jalali-Farahani, et al. ("Jalali-Farahani, et al.") and excerpts from Streetman's book entitled "Solid State Electronic Devices" ("Streetman"). Claims 20 and 44 stand rejected under 35 U.S.C. §103 as allegedly unpatentable over Jalali-Farahani, et al. and U.S. Patent No. 6,087,683 to King, et al. ("King, et al.").

In regard to method Claims 1-23, applicants respectfully submit that the method claims of the present application are not obvious from the combined disclosures of Jalali-Farahani, et al. and Streetman or Jalahi-Farahani, et al. and King, et al. since none of the applied references teaches or suggests a method of fabricating a semiconductor device which includes a step of providing a collector having a first doping type which includes a subcollector and a diffusion, *wherein the diffusion has a vertical width sufficiently narrow to avoid lowering the collector-base breakdown voltage and a doping sufficiently high to restrict base widening when the base-emitter junction is forward baised.*

Applicants respectfully submit that the diffusion of the claimed invention improves the AC performance of the SiGe heterojunction bipolar transistor as well as the speed and ruggedness of the transistor.

Jalali-Farahani, et al. provide a method for making a silicon heterojunction bipolar transistor which includes the steps of (a) forming a substantially single-crystalline Si collector region of a first conductivity type within a window defined in a layer of dielectric material; (b) forming, over the collector region and over at least a portion of the dielectric layer adjacent to the collector region, a Si nucleation layer and then a SiGe alloy layer of a second conductivity type opposite to the first conductivity type such that each resulting layer has a

part to be referred to as intrinsic that verlies the collector region and a part to be referred to as extrinsic that overlies the dielectric layer, and such that each resulting layer is substantially epitaxial in the intrinsic part thereof and substantially polycrystalline in the extrinsic part thereof; (c) forming, over the alloy layer, a Si emitter layer of the first conductivity type such that the resulting emitter layer comprises a substantially epitaxial part that overlies the collector region and a substantially polycrystalline part that overlies the dielectric layer; and (d) implanting doping species of the second conductivity type into the extrinsic parts of at least the SiGe alloy layer and the emitter layer while substantially excluding the dopant species from the intrinsic parts of the alloy layer and the emitter layer. In accordance with the disclosure of Jalali-Farahani, et al., the implanting step leads to a doping level of the second conductivity type in both the extrinsic part of the alloy layer and the extrinsic part of the emitter layer.

Applicants respectfully submit that the disclosure of Jalali-Farahani, et al. does not teach or suggest forming a diffusion within the collector region, let alone a *diffusion which has a vertical width sufficiently narrow to avoid lowering the collector-base breakdown voltage and a doping sufficiently high to restrict base widening when the base-emitter junction is forward baised.* These limitations on the diffusion region, which are essential to the claimed method, are not taught or suggested by Jalali-Farahani, et al.

Streetman does not alleviate the above defects in Jalali-Farahani, et al. since the applied secondary reference also does not teach or suggest forming a diffusion region within the collector region, let alone a *diffusion which has a vertical width sufficiently narrow to avoid lowering the collector-base breakdown voltage and a doping sufficiently high to restrict base widening when the base-emitter junction is forward baised.* Instead, Streeman discloses

that it is common-place to use a thermal process such as RTA to diffuse dopant species from a region of high concentration to another region within a substrate of an IC structure. Streetman provides no guidance whatsoever for forming a diffusion in a collector region of a bipolar transistor, let alone for forming a *diffusion which has a vertical width sufficiently narrow to avoid lowering the collector-base breakdown voltage and a doping sufficiently high to restrict base widening when the base-emitter junction is forward baised.* As such, the combined disclosures of Jalali-Farahani, et al. and Streetman do not render applicants' claimed method obvious since none of those applied references teaches or suggests forming applicants' claimed diffusion region.

King, et al. also do not alleviate the above-mentioned defects in Jalali-Farahani, et al. since the applied secondary reference does not teach or suggest forming a diffusion region in a collector region of a bipolar transistor, let alone forming a *diffusion region which has a vertical width sufficiently narrow to avoid lowering the collector-base breakdown voltage and a doping sufficiently high to restrict base widening when the base-emitter junction is forward baised.* King, et al. provide a method for forming a bipolar heterostructure which includes the steps of: forming a n-type doped collector region in a semiconductor substrate; forming a SiGe base on the collector; epitaxially doping the base with In while forming the base to achieve a natural concentration of In in the base; and forming an emitter on the base. Applicants respectfully submit that King, et al. do not teach or suggest forming a diffusion region in the collector which has the limitations recited in the claims of the present application. As such, the combined disclosures of Jalali-Farahani, et al. and King, et al. does not render applicants' claimed method obvious.

In view of the above remarks, the combined disclosures of Jalali-Farahani, et al. and Streetman or Jalali-Farahani, et al. and King, et al. do not render applicants' method claims obvious since none of the applied references teaches or suggests forming applicants' claimed diffusion region in a collector region of a bipolar transistor structure.

Insofar as Claims 24-44 are concerned, applicants submit that the claimed bipolar transistor is not rendered obvious from the combined disclosures of Jalali-Farahani, et al. and Streetman or Jalali-Farahani, et al. and King, et al. since none of the applied references teaches or suggests a bipolar transistor which comprises a collector region having a first doping type which includes a subcollector and a diffusion, *wherein said diffusion has a vertical width sufficiently narrow to avoid lowering collector-base breakdown voltage and a doping sufficiently high to restrict base widening when the base-emitter junction is forward baised.*

Jalali-Farahani, et al. provide a heterojunction bipolar transistor which has intrinsic and extrinsic base portions. The intrinsic base portion substantially comprises epitaxial SiGe, while the extrinsic base portion substantially comprises polycrystalline material, which contains a distribution of ion-implanted impurities. An emitter overlies the intrinsic base portion, and a spacer at least partially overlies the emitter. The spacer overhangs the extrinsic base portion by at least a distance characteristic of lateral straggle of the ion implanted species.

Applicants respectfully submit that Jalali-Farahani, et al. do not teach or suggest a bipolar transistor which comprises a collector region having a first doping type which includes a subcollector and a diffusion, *wherein said diffusion has a vertical width sufficiently narrow to avoid lowering collector-base breakdown voltage and a doping sufficiently high to*

restrict base widening when the base-emitter junction is forwarded baised. Nowhere in the disclosure of Jalali-Farahani, et al. is a diffusion region mentioned in the collector region that has the limitations recited in the structure claims of the present application.

Streetman discloses IC structures in which thermal heating is used to form a diffusion region in the semiconductor substrate. Applicants respectfully submit that Streetman is not related to bipolar transistor devices, let alone a bipolar transistor device having a diffusion present in the collector region thereof, wherein the diffusion *has a vertical width sufficiently narrow to avoid lowering collector-base breakdown voltage and a doping sufficiently high to restrict base widening when the base-emitter junction is forward baised.* As such, the combined disclosures of Jalali-Farahani, et al. and Streetman do not render applicants' claimed bipolar transistor structure obvious.

Insofar as the combination of Jalali-Farahani, et al. and King, et al. is concerned, applicants respectfully submit that King, et al. do not alleviate the above-mentioned defects in Jalali-Farahani, et al. since the applied secondary reference also fails to teach or suggest a bipolar transistor structure which includes applicants' claimed diffusion region present in the collector region of the device. As such, the combined disclosures of Jalali-Farahani, et al. and King, et al. do not render applicants' claimed structure obvious.

The §103 rejection also fails because there is no motivation in the applied references which suggests modifying the disclosed methods and structures to include the various features, particularly the claimed diffusion which has a vertical width sufficiently narrow to avoid lowering collector-base breakdown voltage and a doping sufficiently high to restrict base widening when the base-emitter junction is forward baised. Thus, there is no motivation provided in the applied references, or otherwise of record, to make the modification

mentioned above. "The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." In re Vaeck, 947 F.2d, 488, 493, 20 USPQ 2d. 1438, 1442 (Fed.Cir. 1991).

The rejections under 35 U.S.C. §103 have been obviated; therefore reconsideration and withdrawal thereof are respectfully requested.

Thus, in view of the foregoing amendments and remarks, it is firmly believed that the present case is in condition for allowance, which action is earnestly solicited.

Respectfully submitted,

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